a nsf-noaa partnership

Telepresence field research experience for undergraduate and graduate students: A NOAA Ship *Okeanos Explorer/AUV Sentry* success story*

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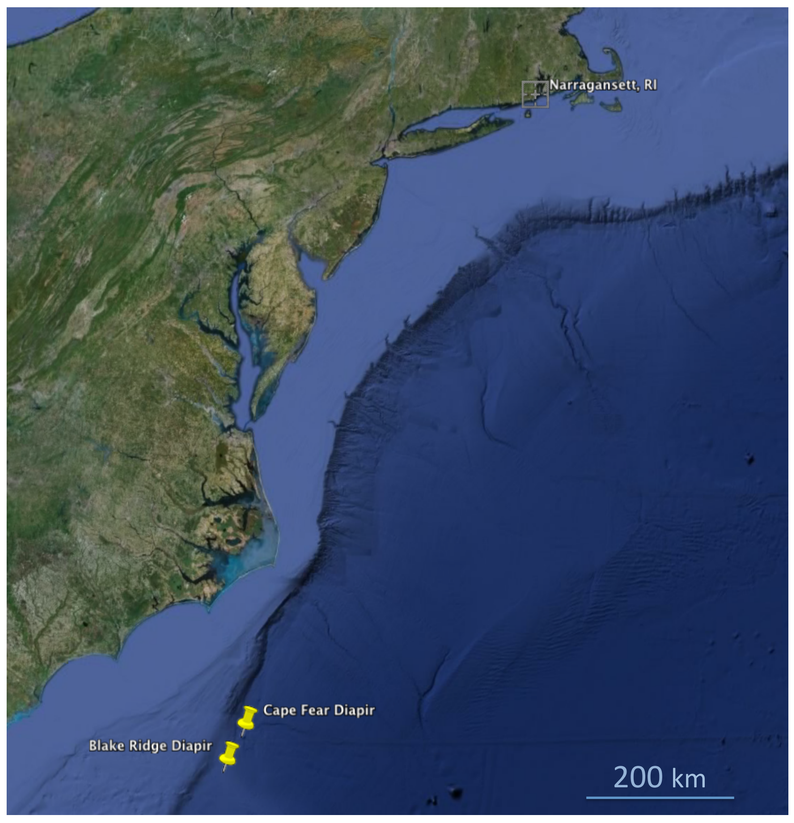
The Challenge:

Run an at-sea AUV-based research expedition with

- shore-based Co-Chief Scientists and Senior Engineer,
- shore-based mission planning for an autonomous underwater vehicle
- shore-based team of students with limited deep-sea experience
- mission-critical-only at-sea science and operations team



The shore-based team planned missions in Rhode Island for remote (~1050 km) AUV missions off North Carolina to locate seep communities in relation to the geological setting at the Blake Ridge and Cape Fear Diapirs.

The Inner Space Center, University of Rhode Island. The large screen shows Sentry on deck and is used to share data projcts for planning during ship-shore telepresence meetings. Image: B Kennedy NOAA OE.

Shoreside Stats:

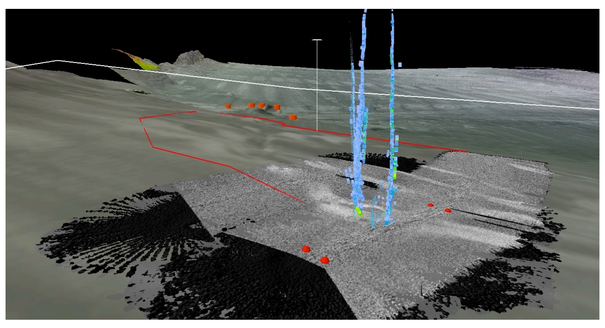
80 person hours per day

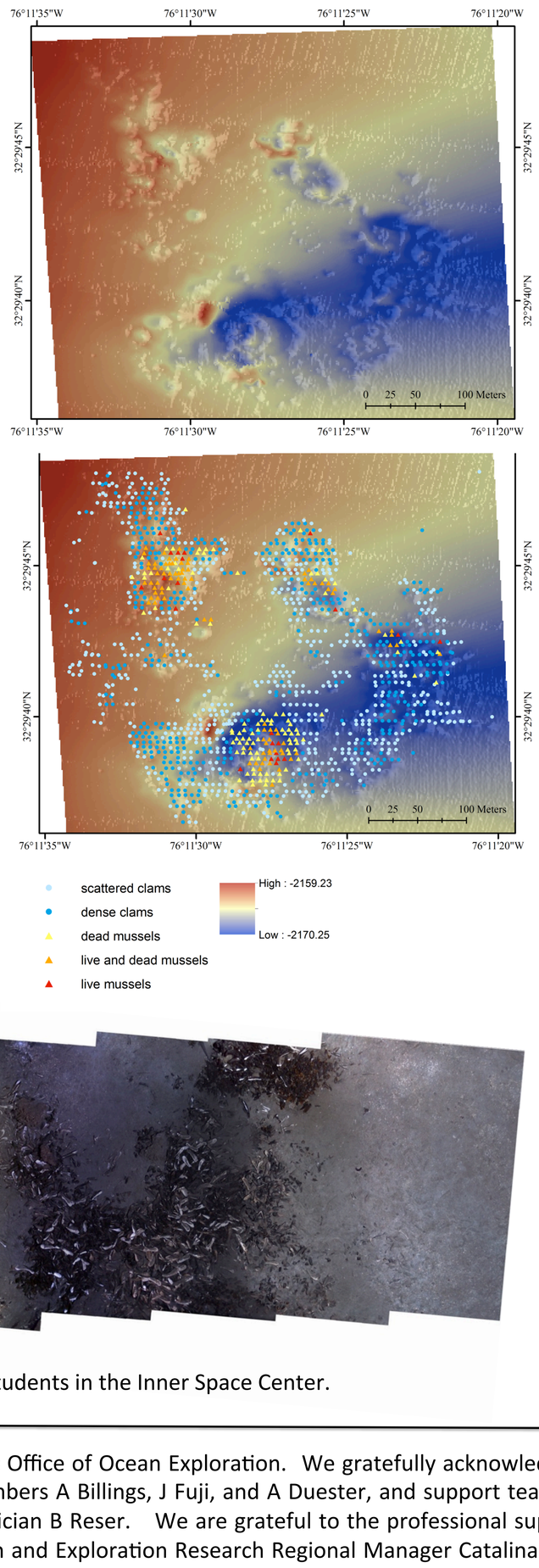
6 terabytes of AUV data

68,000 seafloor photos

AUV SENTRY and the shore-based team at the *Inner Space Center.*

Finding the Signals





'At-sea' photomosaic of a seep habitat generated by students in the Inner Space Center.

The Approach:

Morning

1) Shoreside and shipboard teams analyze data from the previous Sentry dive.
2) Daily shoreside science meeting.
3) Shoreside team drafts a mission profile for the next Sentry dive.
4) Joint shoreside-shipboard telepresence conference:
   - New science findings
   - Engineering and operations strategy update
   - Review and revise mission profile for upcoming dive.

Afternoon

1) Shoreside team finalizes mission profile and sends to AUV team on *Okeanos Explorer*
2) AUV team uploads mission and deploys the vehicle

Evening

1) Continue data analysis and daily reports from teams shoreside.

INNOVATE • EXPLORE • ANALYZE
MAP • UNDERSTAND • SHARE

AUV Mission Training via Telepresence: Key Rules of Engagement

- Identify compelling exploration goals and address them with powerful mappnig tools
- Engage trainees in all ship-shore planning sessions from the start
- Enable trainees by engaging them in team projects and empowering teams to contribute to planning missions
- Critical mass: group dynamics across disciplines, skill sets, and experience enable problem solving, creativity, productivity
- Teach trainees how to plan science missions and give them increasing responsibility for planning missions using as they become experts through data analysis
- Daily meetings with trainees: updates, status reports, challenges, needs, bottlenecks
- Share information – everyone needs to know
- Facilitate rich social interactions among scientists, engineers, and students and shared experiences with the ship
- Provide shore-based support for analytical tools (expertise, software)
- Celebrate the privilege, capture the excitement, let your passion show

AUV SENTRY and the shipboard team, NOAA Ship *Okeanos Explorer*

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